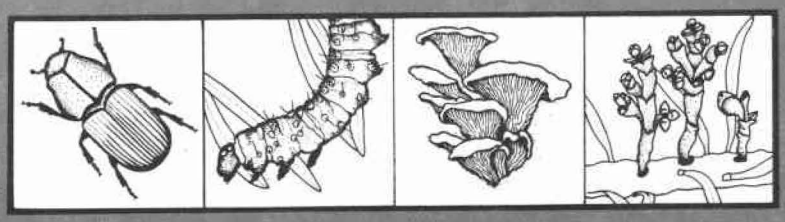
Forest Pest Management



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EFFECTS OF WATER RINSE TREATMENTS ON OCCURRENCE OF FUNGI ON SPRUCE SEED FROM THE TOWNER NURSERY, NORTH DAKOTA

by

R. L. James
Plant Pathologist

INTRODUCTION

Fusarium root diseases cause problems in conifer seedling production seedbeds at the North Dakota Forest Service Towner Nursery, North Dakota. Damping-off and root disease are especially damaging in bareroot beds of Colorado blue spruce (*Picea pungens* Engelm.) and Black Hills spruce (*Picea glauca* var. *albertiana* (S. Brown) Sarg.). Previous work (James 1985) indicated that many seeds of both spruce species were often infected with several species of *Fusarium.*

Seed treatments, including rinsing seed under running water for 48 hours were effective in greatly reducing or eliminating *Fusarium* on seed (James 1985). As a result, growers at the nursery instituted an operational seed treatment process aimed at reducing *Fusarium* inoculum on seed. The treatment method included rinsing seed under standard tap water three times and then placing them in a running water soak for 48 hours.

This report summarizes an evaluation on the effectiveness of this water rinse treatment in reducing *Fusarium* and other common seed fungi and bacteria on spruce seed from the nursery.

METHODS

Two seedlots each of Colorado blue spruce and Black Hills spruce were assayed for presence of fungi and bacteria. Samples of each seedlot included seed which had been treated with the operational water rinse and some which were untreated. Two hundred fifty seed per lot per treatment were randomly selected and aseptically placed on a selective agar medium for *Fusarium* (Komada 1975). In addition, 50 pieces of seed debris (wings, cone scales, pitch globules, etc.) were assayed from each sample for presence of *Fusarium.* All plates were incubated at about 22 degrees C under cool fluorescent light for 7 days, after which they were examined for presence of fungi and bacteria growing from either seed or debris. Data were analyzed using a two-way analysis of variance, standard "t" test to compare means, Tukey's comparison test, and simple linear regressions.

United States Department of Agriculture | Forest Service | Northern Region | P.O. Box 7669 Missoula, Montana 59807

RESULTS AND DISCUSSION

Occurrence of fungi and bacteria on sampled seed is summarized in table 1. *Fusarium* spp. were significantly (P=0.01) reduced as a result of the water rinse treatment. There were also significant differences (P=0.01) in occurrence of *Fusarium* on the different seedlots tested. One seedlot (4-84) of Colorado blue spruce had fairly high levels of *Fusarium*, whereas the other tested lot (4-79) had low levels of these fungi. Likewise, one lot (1-84) of the Black Hills spruce was extensively infected with *Fusarium* and the other lot (2-81) had much less infection. Seedlot 1-84 was also extensively infected with *Fusarium* when tested previously (James 1985). Unfortunately, the water rinse treatment did not eliminate all the *Fusarium* on seed. Levels present after treatment may have been high enough to cause seed germination and seedling establishment problems when planted. Information correlating amount of seed infection with extent of damping-off and root disease is not yet available. However, Douglas-fir seedlots with 1-2 percent *Fusarium* infection may have relatively high levels of disease, especially when grown in containers (James, unpublished).

Four other categories of organisms on seed are reported in table 1. These include common seed colonizers, such as *Penicillium* spp. and unidentified bacteria, and possible antagonists of *Fusarium*, such as *Trichoderma* spp. *Trichoderma* and bacteria levels on seed were significantly decreased as a result of the water rinse treatment. However, *Penicillium* levels and levels of all fungi except *Fusarium* were unaffected. Regressions comparing *Fusarium* seed infection with infection by other fungi are summarized in table 2. Correlations between *Fusarium* infection and infection with other fungi were not high, indicating that occurrence of one group of fungi on seed did not significantly affect occurrence of another group.

Occurrence of *Fusarium* on seed debris is summarized in table 3. Treatment with water rinses did not significantly reduce amount of *Fusarium* on seed debris when all seedlots were pooled together; however, treatment did significantly (P=0.01) reduce *Fusarium* on debris from seedlot 1-84, but not on the other seedlots tested. A regression to correlate amount of *Fusarium* on debris with that on seed produced a coefficient of determination of 0.89, which would indicate a high correlation between these two variables. This might indicate that the fungus spreads from debris to seeds during processing or stratification or vice versa.

This evaluation indicated that the new operational water rinse treatment employed at the Towner Nursery greatly reduced *Fusarium* on seed of both Colorado blue spruce and Black Hills spruce. However, the fungus was not entirely eliminated from treated seed. Some other fungal and bacterial colonizers of seed were also affected by the treatment but correlations between occurrence of these organisms and *Fusarium* spp. on seed were not high. Effects of the water rinse treatment on seed germination, seedling establishment, and disease incidence should be assessed to determine if residual amounts of *Fusarium* on seed are sufficient to be of concern. It is known that the *Fusarium* spp. isolated from spruce seed at the Nursery are capable of causing disease (James 1985). However, threshold levels of *Fusarium* on seed that are required to elicit damage in seedbeds are unknown.

Table 1.--Occurrence of selected fungi on spruce seed from the Towner Nursery

			Percentages				
1/Species	Seedlot	2/Trtmt	Fusarium	Trichoderma	Penicillium	Bacteria	3/All but Fusarium
CBS	4-84	U	^25.2B	7.6	48.0	18.4	48.4
CBS	4-79	U	1.6C	8.8	90.8	0	100.0
BHS	1-84	U	83.2A	3.2	4.0	0	8.8
BHS	2-81	U	3.6C	0.4	22.8	9.6	49.6
ALL		U	*28.4	*5.0	*41.4	*7.0	*54.2
CBS	4-84	T	14.0B	6.8	56.6	1.6	79.6
CBS	4-79	T	4.4C	0	100.0	0	100.0
BHS	1-84	T	5.6C	2.4	7.6	0	18.0
BHS	2-81	T	2.8C	0.8	10.8	4.8	32.0
ALL		T	*6.7	*2.5	*43.0	*1.6	*57.4

1 CBS = Colorado blue spruce; BHS = Black Hills spruce.

2 U = untreated; T = treated (rinsed three times and soaked in running water for 48 hours).

3 Includes all fungi except Fusarium.

^ Within each column, means followed by the same capital letter are not significantly different (P=0.05) using Tukey's comparison test (all percentages underwent arc-sin transformation prior to statistical tests).

* Untreated vs treated means compared with standard "t" test:

	Fusarium	Trichoderma	Penicillium	Bacteria	All except Fusarium
t	3.42	2.08	- 0.68	2.89	- 0.47
+ (P=0.01)	2.64	2.64	2.64	2.64	2.64
+ (P=0.05)	1.99	1.99	1.99	1.99	1.99

Table 2.--Regression equations and coefficients of determination (CD) for comparisons between spruce seed infection with *Fusarium* and infection with other fungi.

1. **Fusarium vs. Trichoderma**

   CD = 0.05

   y = 14.89 + 0.69 x

2. **Fusarium vs. Penicillium**

   CD = 0.17

   y = 33.26 - 0.29 x

3. **Fusarium vs. All fungi except Fusarium**

   CD = 0.27

   y = 40.53 - 0.37 x

Table 3.--Occurrence of *Fusarium* on spruce seed debris from the Towner Nursery

Species 1/	Seedlot	U 2/	T 3/	t Value 4/	Significance
CBS	4-84	20.0	22.0	0.26	NS
CBS	4-79	6.0	8.0	- 0.38	NS
BHS	1-84	28.0	12.0	3.44	P=0.01
BHS	2-81	8.0	10.0	- 0.22	NS
ALL		17.5 4/	13.0	1.0	NS

1/ CBS = Colorado blue spruce; BHS = Black Hills spruce

2/ U = Untreated

3/ T = Treated (rinsed three times and soaked in running water for 48 hours

4/ Untreated vs. treated means compared with standard "t" test

LITERATURE CITED

James, R. L. 1985. Pathogenic *Fusarium* on spruce seed from the Towner Nursery, North Dakota. USDA Forest Serv., N. Reg. Rept. 85-23. 9 p.

Komada, H. 1975. Development of a selective medium for quantitative isolation of *Fusarium oxysporum* from natural soil. Rev. Plant Protec. Res. 8: 114-125.